Office of Operating Experience Analysis, EH-33 • U.S. Department of Energy • Washington, D.C. 20585

OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

January 22 - January 28, 1999

Summary 99-04

Operating Experience Weekly Summary 99-04

January 22 through January 28, 1999

Table of Contents

Visit Our Website

The Weekly Summary is available, with word search capability, via the Internet at **http://tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html**. If you have difficulty accessing the Weekly Summary at this URL, please contact the ES&H Information Center, 1(800) 473-4375, for assistance. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of I-Ling Chow, (301) 903-5984, or Internet address i-ling.chow@hq.doe.gov, so we may issue a correction.

EVENTS

1. CONDENSATE-INDUCED WATER HAMMER

On January 20, 1999, at the Rocky Flats Environmental Technology Site, a stationary operating engineer (SOE) heard water hammer sounds as he opened an isolation gate valve in a 6-inch, 30-psig steam line. The SOE was reintroducing steam to a heating coil following maintenance. When he heard the water hammer, he immediately shut the valve. Water hammer probably occurred because SOEs did not properly drain condensate from the steam line before admitting steam into the line. Water hammer events are significant because they can cause fatalities, personnel injury, and equipment damage. (ORPS Report RFO--KHLL-SOLIDWST-1999-0003)

Following maintenance on a steam heating coil in a laundry facility, the configuration control authority authorized removal of a lockout/tagout from a valve isolating the heating coil. SOEs opened a drain to remove condensate, but they did not observe any drainage from that point. After the lockout/tagout was removed, an SOE slowly opened the isolation gate valve in the steam line. He heard loud banging noises and immediately shut the valve. A utilities foreman and an engineer walked down the system and found no physical damage.

Investigators determined that operational responsibility for the laundry steam system had been assigned to a new organization. The previous organization's practice was to drain the system at a known low point before reintroducing steam following an outage. Investigators determined that the new organization was not given a turnover on how to drain the system and they tried to drain it at a location that was not the low point. They also determined that the shift manager was aware that the lockout/tagout would be removed but was under the impression that no valves would be manipulated. Involved personnel did not conduct a formal pre-evolution briefing. Investigators determined that involved personnel could have used facility procedures, operations orders, and site standing orders to safely guide the work, but that not one of these guides had been used.

Water hammer events have resulted in deaths at DOE facilities. On June 7, 1993, a water hammer event at Hanford resulted in a valve rupture and fatal injury (ORPS Report RL--WHC-WHC300EM-1993-0022). The *Type A Accident Investigation Board Report, June 7, 1993, U-3 Steam Pit Valve Failure Resulting in a Fatality at the Department of Energy Hanford Site*, identified probable causes of the event to be inadequacies in operating practices, lessons learned, training, operating procedures, policy, guidance, safety implementation, design, and oversight. In 1986, a condensate-induced water hammer at the Brookhaven National Laboratory resulted in two fatalities and two severe injuries. The *Type A Accident Investigation Board Report of the Steam Line Accident with Fatal Injuries on October 10, 1986, at the Brookhaven National Laboratory* determined that the direct cause was the use of an in-line gate valve to remove condensate instead of drains that had been installed for that purpose. There were no written instructions for warming and activating the steam lines, and there was no formal training program to familiarize steam fitters with specific systems at Brookhaven.

Water hammer can cause severe piping and equipment damage. It can also cause uncontrolled releases of hazardous materials and serious injury or death. These events can be prevented with planning, procedures, equipment design and condition, and cognizance of steam and water conditions. Appropriate training and procedures provide a measure of protection against water

hammer. Managers at DOE facilities should review their procedures and training to determine if their controls will prevent water hammer damage.

DOE/EH-0560, Safety Notice 98-02, *Water Hammer*, states that steam must not be allowed to mix with water, either by injecting water into steam systems or steam into water systems. Steam and water cannot be mixed in a piping system without risking condensate-induced water hammer. Condensate should be assumed to be present in all low points and dead legs until proven otherwise. The following safety recommendations should be incorporated into training and retraining programs for steam system maintenance technicians, operators, and supervisors. They should be followed regardless of piping size.

- Do not introduce steam into piping without verifying that no liquid water is present.
- Warm cold steam piping slowly, keeping blow-down valves for traps open.
- Walk down steam systems and check for proper location, distribution, and sizing of steam traps and blow-down valves for start-up and operation.
- Inspect steam traps frequently for proper operation.
- Do not crack open valves to avoid a condensate-induced water hammer. This will not guarantee safe operation. A steam-propelled water slug can form at very low flow conditions.
- Verify that traps are operating properly before opening steam line valves. On start-up, open blow-down valves fully and leave them open until liquid stops flowing.
- When feasible, operate valves remotely using mechanical extension linkage, reach rods, or power-operated valves. Ensure that reach rods and extension linkages are properly maintained.
- Inspect piping systems for sagging and, if necessary, install steam traps at low points or repair the sag.
- Check and repair piping insulation to reduce condensate formation in the piping and to save energy.
- Provide isolation valves with bypass systems. Remember that bypass operation will not prevent water hammer if condensate is present.
- Do not use operational methods to permanently overcome design deficiencies in steam/water systems. Correct the system design.

The Safety Notice on water hammer can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Rd., Germantown, MD 20874. Safety Notices are also available at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: water hammer, steam, condensate

FUNCTIONAL AREAS: Mechanical Maintenance, Work Planning, Industrial Safety

2. SUBCONTRACTOR WORK CONTROL VIOLATION AT IDAHO

On January 18, 1999, at the Idaho National Engineering Environmental Laboratory, an operator exercised her stop work authority when she observed environmental services subcontractor personnel had removed a caustic storage tank flange and had taken a sample from the tank without obtaining authorization for this work. A technical work leader had briefed the operator that the subcontractors were authorized only to erect scaffolding and that there were no plans to

open the tank or sample its contents. When the operator arrived on the scene, she observed that the subcontractors had removed the flange and had taken the sample from the tank. She immediately confirmed with the technical work leader that flange removal and sampling were not authorized and then stopped the work. The operator notified the appropriate managers and safety personnel of this event. The facility manager directed facility construction work to be placed on hold until facility personnel can verify if additional construction work control issues exist. (ORPS Report ID--LITC-TRA-1999-0002)

Investigators determined that the bulk caustic storage tank had approximately 800 gallons of caustic product in it. They also determined that the tank was scheduled to be permanently removed from service. However, the tank was still in service and available for use when the subcontractors opened it and obtained the sample.

The facility manager held a critique on this event. Critique attendees identified the following work control issues.

- No one included tank opening or sampling on the facility short-range schedule or the Plan of the Day, so they were not approved for work. Facility construction management personnel had approved scaffolding erection and area setup in preparation for taking the caustic tank out of service. They included this work on the schedule and ensured that the work control documents for the authorized work were in place. The schedule did not include opening the tank, because it was still available for use.

- Facility construction management personnel had discussed the work that was authorized with the support services subcontractor at the morning Plan of the Day meeting. They also reiterated to the subcontractor that only authorized work could be performed and any additional work would require the same level of review and approval as work already authorized. The subcontractor stated in the critique that he had been aware of this requirement.

- The facility safety engineer did not inspect the scaffolding or approve it for use. In addition, subcontractor personnel removed the access at the top of the caustic tank to allow erection of the scaffolding. This access removal was not approved and the associated work control documents were not in place.

- Facility environmental personnel told the support services subcontractor that a tank sample would be required to comply with Resource Conservation and Recovery Act requirements before the tank was drained and flushed. Facility environmental personnel were not aware of what work was authorized on the schedule. Subcontractor personnel obtained the sample when they removed the caustic tank flange for scaffolding erection. They stated at the critique that they believed that they took direction for the conduct of work only from the facility construction management personnel.

- No one performed a job safety analysis or issued a work permit for tank flange removal or tank sampling. Facility safety personnel evaluated the workers' personal protective equipment after they sampled the tank and found it to be adequate.

- No one evaluated the need for a lockout/tagout before opening the caustic tank. Facility safety personnel determined that a lockout/tagout should have been required because the tank was still available for use.

DOE facility managers directed the facility site area director to reinstate a full-time Senior Supervisory Watch for all work performed by personnel who are not permanently assigned to the facility. The facility manager will continue to review this event and will implement corrective actions as necessary.

NFS has reported failure to follow or implement work control programs in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-50 reported that an electrical engineer at the Rocky Flats Environmental Technology Site Broomfield Warehouse accidentally contacted an inadequately wrapped bolted 480-V cable connection with a clamp-on ammeter, causing an electrical arc and a blown fuse in the power distribution panel. Investigators determined that because the Broomfield warehouse is off-site and is not a DOE facility, no one implemented the necessary work control programs or safety measures. (ORPS Report RFO--KHLL-371OPS-1998-0085)

- Weekly Summaries 98-30, 98-33, 98-38, and 98-43 reported on an event in which a high-pressure carbon dioxide (CO_2) fire suppression system unexpectedly activated, resulting in one fatality, several life-threatening injuries, and significant risk to the safety of the initial rescuers. A Type A Accident Investigation Board Report identified two root causes for the accident. First, Lockheed Martin Idaho Technologies Company (LMITCO) did not have a systematic method for identifying, institutionalizing, or implementing requirements for the design, installation, and work conducted on or affected by the CO_2 fire suppression system. Second, the DOE Idaho Operations Office and LMITCO management had accepted unstructured work controls, which helped to increase industrial safety risks to workers. (Weekly Summaries 98-30, 98-33, and 98-38; Type A Accident Investigation Board Report on the July 28, 1998, Fatality and Multiple Injuries Resulting from the Release of Carbon Dioxide at Building 648, Test Reactor Area, Idaho National Engineering and Environmental Laboratory; ORPS Report ID--LITC-TRA-1998-0010)

These events underscore the importance of an integrated approach to safety that stresses clear goals and policies, individual and management accountability and ownership, implementation of requirements and procedures, and thorough and systematic management oversight. The responsibility for ensuring adequate planning and control of work activities resides with line management. Managers should ensure that work control processes are followed and facility practices are enforced. In the Idaho tank sampling event, pre-job briefings were conducted in which the subcontractor was specifically told not to perform work other than scaffolding erection and area setup. Despite this instruction, the subcontractor opened the tank access without any additional approvals or guidance. He then obtained a sample at the request of facility environmental personnel, again without approval or guidance.

Personnel at DOE facilities should have a continually questioning attitude toward safety issues. Subcontractor personnel in the Idaho event had been trained to use only scaffolding that was inspected and approved by safety personnel. Each individual is ultimately responsible for complying with rules to ensure personal safety. Facility managers should communicate the idea that safety is of prime importance and that all personnel must be committed to excellence and professionalism. Worker training should emphasize that changes in work methods or equipment, or any other deviation from an approved work plan, can introduce unforeseen hazards. Changes to approved work methods and equipment must receive the same hazard analysis, review, and approval as the original work plan. Any change should entail a work stoppage combined with a thorough review of the potential hazards associated with the change. Workers should also be trained to stop work and report as-found conditions that are inconsistent with expected conditions.

Personnel at DOE facilities are required to follow established work control programs without exception. Facility managers, work planners, and crafts personnel should review the following references, which provide guidance and good practices for implementing work control plans.

- DOE O 4330.4B, *Maintenance Management Program,* chapter 6, provides guidance for preparing and using procedures and other work-related documents that contain appropriate work directions. Section 6.2 states that deficient procedures and failure to follow procedures are major contributors to many significant and undesirable events. Section 7 provides guidance for planning, scheduling, and coordinating work activities. Section 8.3.6 states that nonfacility contractor and subcontractor personnel should be trained and qualified for the work they are to perform. It also states that subcontractor personnel should perform work to the same high standards expected of facility personnel and that subcontractor managers should be held accountable for the work performance of their personnel.

- DOE-STD-1053-93, *Guideline to Good Practices for Control of Maintenance Activities at DOE Nuclear Facilities*, provides extensive guidance for the development of work control plans and the supervision of maintenance activities.

Integrated safety management information can be found at http://tis-nt.eh.doe.gov/ism. DOE technical standards are at http://www.doe.gov/html/techstds/standard/standard.html.

KEYWORDS: work planning, construction, contractor controls

FUNCTIONAL AREAS: Work Planning, Industrial Safety, Lessons Learned

3. UNEXPECTED RADIATION READINGS FROM A SHIPPING CASK

On January 18, 1999, at the Savannah River Laboratory Technical Area, technicians who were opening what they thought was an empty 8-ton shipping cask for inspection noted high radiation readings just after they raised the cask lid. They immediately lowered the lid back onto the cask and secured it with bolts. A safety and health office inspector had measured 20 rad/hr at the top of the cask near the gap between the lid and cask. Health physics personnel read thermoluminescent neutron dosimeters for the four workers involved in the task. The highest dose received was 6 mrem. This occurrence is significant because workers did not know the contents of the cask or had not anticipated the elevated dose rates they encountered during this task. (ORPS Report SR--WSRC-LTA-1999-0001)

The cask is approximately 3 feet in diameter and 4½ to 5 feet high. It is comprised of approximately 10 inches of lead shielding clad in ¼-inch stainless steel. The shielded lid weighs approximately 1,000 pounds, and lifting it requires an overhead crane. The cask normally is loaded underwater and contains water to minimize radiation exposure and transport of contamination. Workers were to have surveyed the cask for internal contamination before transferring it to another facility to be reused. It was one of three similar casks, at least one of which was known to contain radioactive material. Workers had selected a cask they thought was empty. Based on an examination of logs and other documentation, they now believe the cask they opened contained reactor parts, such as universal sleeve housings and tie rod bolts, placed there during decommissioning of K-Reactor in 1988. The cask was last surveyed in 1991; however, an external survey would not have revealed radioactive materials stored within it.

Investigators discussed several factors that may have contributed to this occurrence, one of which is a significant loss of process knowledge. The facility lost four essential supervisors when

the O&M contract was transferred from DuPont Chemical to the Westinghouse Savannah River Company in 1993. Much of the staff has been replaced since then. Staff turnover was aggravated by a general lack of rigidity in the control of radioactive materials in the past and less-than-adequate record keeping. Investigators also discussed inadequacies in work planning for this task. Facility personnel proceeded on the assumption that the casks were empty, but they did not verify their assumption by reviewing logs and other documentation that may have been available.

In response to the occurrence, the facility manager suspended all further work on the casks pending development of a suitable work plan. Facility personnel tagged and labeled all three casks as potential high radiation or very high radiation areas and stored them in the same area. They also plan to analyze logs and to develop a plan to review and verify the contents of other casks and shielded containers in storage.

NFS reported a similar occurrence in Weekly Summary 98-09. A construction crew foreman at the Oak Ridge National Laboratory learned at the last minute that his planned removal of cell plugs would have resulted in personnel being exposed to radiation fields estimated at 25 to 30 rem/hr. The foreman was preparing to remove the shield plugs from two cells at the Waste Management and Remedial Action Facility to conduct preliminary characterization of the cells. He notified the building operations supervisor of his intentions. The supervisor, who was the final administrative barrier, told him not to initiate any work because the two cells were active and contained material with significant radioactivity. The construction crew foreman halted work preparation. (ORPS Report ORO--ORNL-X10WSTEMRA-1998-0003)

These events underscore the importance of performing thorough reviews of work activities to identify radiological and safety hazards. Such reviews should consider past operations at the facility. Because past operations and radiological controls may not have been consistent with today's practices and requirements, it would not be unusual to find unexpected high radioactivity or contamination levels.

The cleanup, decommissioning, dismantling, remediation, or refurbishing of older facilities can pose risks of high contamination and radiation in unexpected locations, challenging the DOE radiological control policy of maintaining personal radiation exposure as low as reasonably achievable (ALARA). Activities of this type may require extraordinary planning, coordination, and effort before any work is executed. DOE/EH-256T, *Radiological Control Manual*, part 1, "Planning Radiological Work," states that technical requirements for the conduct of work, including construction, modification, operation, maintenance, and decommissioning, shall incorporate radiological criteria to ensure safety and maintain radiation exposures ALARA.

KEYWORDS: cask, decommissioning, radiation, work planning

FUNCTIONAL AREAS: Industrial Safety, Radiation Protection, Work Planning

4. FROZEN WATER LINE RESULTS IN DISCHARGE OF FOAM FIRE SUPPRESSION SYSTEM

On January 5, 1999, at the Federal Energy Technology Center, an unplanned discharge of a foam fire suppression system occurred because of a frozen water actuation line. The actuation line (pressurized pilot line) controls the operation of a main water supply line to the foam system. Extremely cold weather (approximately 5 degrees Fahrenheit) caused the line to freeze. When the line thawed, the resulting leaks reduced the pilot water pressure until an actuation valve opened, causing the foam suppression system to discharge. Damage caused by freezing water pipes can be costly to facility operations and in most cases is avoidable. (ORPS Report HQ--GOPE-FETC-1999-0001)

The facility handles chemicals and stores chemical drums both indoors and outdoors. It is protected by a water fire suppression system inside the building and a foam fire suppression system outside. Foam is used outside to minimize the environmental impact of the runoff that comes when a water system actuates. The bulk of the foam suppression system resides inside the building, which is typically maintained between 50 and 75 degrees Fahrenheit.

Investigators determined that workers had removed a door sill plate on an outside door to allow for easier movement of drums into the storage building. They believe that the gap left by the missing sill allowed enough cold air in to freeze the water in the pilot line. The pilot line runs near the door on an outside wall. It was not heat-traced because it is inside the heated building. Investigators also determined that moisture may have accumulated in the pneumatic thermostat lines that control the heating system for the building. The loss of pneumatic signal may have produced false temperature readings to the controller that modulates a steam heating valve. Investigators also found that the steam valve restricted full steam flow to the area. They believe the loss of building heating was the primary cause of the event and the gap under the door was a contributing factor.

Facility engineers are evaluating a modification of the pilot actuation system from a water system to a nitrogen system in order to prevent a recurrence of this type of event. Maintenance personnel affixed a door sweep on the bottom of the door to fill the gap left by the removed sill. The sweep provides an adequate seal against the weather without impeding drum-handling. Maintenance personnel also replaced the pneumatic thermostat with a solid-state platinum temperature sensor, and they replaced the steam valve.

This event illustrates how a seemingly small modification (removing a door sill) had a large impact on a facility safety system. During cold weather it is important not to make changes such as removing weather stripping or seals, changing thermostat settings, opening dampers in ventilation systems, or leaving windows and doors open, any of which could affect freeze protection measures. System changes, modifications, or realignments should be evaluated and approved beforehand. It is also important to ensure that building heating systems are operating properly in order to maintain temperatures above freezing.

NFS reported in Weekly Summary 96-03 an event in which personnel in the Rocky Flats Fire Department Building opened a damper for their comfort and convenience. This action later damaged a heating coil by causing it to freeze when temperatures dropped. The damper, which is in a make-up air system, was originally closed by a stationary operating engineer for freeze protection purposes. (ORPS Report RFO--KHLL-SUPPORT-1996-0001)

Fire protection system components are the most commonly affected equipment when freezing conditions exist. NFS has reported numerous inadequate freeze protection events involving fire protection systems. Following are some examples.

- Weekly Summary 97-05 reported two events involving damaged fire protection systems. At the Rocky Flats Environmental Technology Site, 7,000 gallons of water leaked from damaged fire system piping and domestic water lines. The piping systems ran above steel dropped ceilings near a concrete roof, making them difficult to heat. (ORPS Report RFO--KHLL-NONPUOPS2-1997-0001) At the Oak Ridge Y-12 Site, water froze and damaged a fire protection sprinkler system in a building. Ten cast-iron pipe fittings (elbows and tees) cracked. Investigators found an outside door adjacent to the damaged area standing open. Outside temperatures had dropped to 9 degrees Fahrenheit. (ORPS Report ORO--LMES-Y12SITE-1997-0002)

- Weekly Summary 96-03 reported that water in a fire suppression system froze and broke a sprinkler head, releasing 500 gallons of water into the penthouse area of a building at the Los Alamos National Laboratory Radiochemistry Site. The leak resulted in 4 inches of standing water. Two area heaters in the penthouse were not functioning when temperatures dropped to 15 degrees Fahrenheit. (ORPS Report ALO-LA-LANL-RADIOCHEM-1996-0001)

- Weekly Summary 95-50 reported that a maintenance foreman reviewing computer temperature readouts at the Mound Plant discovered water temperatures in fire-protection pipes at 18 degrees Fahrenheit. The piping was in two rooms in a partially decommissioned building. Investigators found that the sprinkler lines had frozen and fallen to the floor. (ORPS Report OH-MB-EGGM-EGGMAT04-1995-0026)

- Weekly Summary 94-48 reported that 180 fire protection sprinklers were damaged by freezing weather conditions at the Oak Ridge K-25 Plant. (ORPS Report ORO--MMES-K25GENLAN-1994-0003)

- Weekly Summary 94-06 reported that a fire suppression sprinkler head froze and broke when heat in a building at Sandia National Laboratory failed. The broken sprinkler released 1,800 gallons of water into a radiologically contaminated building. (ORPS Report ALO-KO-SNL-NMFAC-1994-0002)

NFS published a freeze protection reminder in Weekly Summary 98-34. Facility managers should review this reminder and their cold weather policies and procedures and should walk down systems to identify potential cold weather problems. They should also review the following guidance regarding cold weather protection.

- DOE O 4330.4B, *Maintenance Management Program*, chapter II, section 19, "Seasonal Facility Preservation Requirements," requires a program to prevent equipment and building damage due to cold weather. The Order states that the program should include a freeze protection plan, including details on inspections, preventive maintenance, and corrective maintenance, to ensure continued safe facility operations. Section 16 requires a maintenance history and trending program. Maintenance planners, coordinators, supervisors, and craft personnel should routinely refer to the maintenance history to identify previous maintenance work and its results.

- DOE-STD-1064-94, *Guideline to Good Practices for Seasonal Facility Preservation at DOE Nuclear Facilities*, provides guidance to assist facility maintenance organizations in the review of existing methods (and the development of new methods) for establishing a seasonal maintenance program. Section 3.4.1 of the standard includes cold weather preparation information; Appendix A provides a sample cold weather checklist. This standard also contains guidance for hurricanes, tornadoes, extremely cold weather, flash floods, and other natural disasters.

- DOE-STD-1021-93, *Natural Phenomena Hazards Performance Characterization Guidelines for Structures, Systems, and Components,* provides guidance on assessing system operations to identify hazards to personnel and equipment and on developing hazard prevention or mitigation measures.

- DOE/EH-0213, *Cold Weather Protection*, October 1991, Office of Environment, Safety and Health, Bulletin 91-4, provides insight, corrective actions, and recommendations applicable to sites susceptible to cold weather. This bulletin can be found at http://tis.eh.doe.gov:/80/docs/bull/links.html.

KEYWORDS: freeze protection, fire protection

FUNCTIONAL AREAS: Fire Protection, Operating Experience, Lessons Learned

FINAL REPORT

This section of the OEWS discusses events filed as final reports in the ORPS. These events contain new or additional lessons learned that may be of interest to personnel within the DOE complex.

1. DEFECTIVE POWER SUPPLY ON WELDING MACHINE

NFS reported in Weekly Summary 98-46 that a pipe fitter at the Savannah River Site noticed that the extension cord through which he had powered a drill motor was smoking. He unplugged the tool and notified his supervisor of the condition. The pipe fitter had powered the tool through a 50-foot extension cord from a duplex utility receptacle on a gasoline-powered portable welding machine. Post-use inspection revealed extensive damage to the drill motor and the welding machine. This occurrence is significant because it compromised employee safety. (ORPS Report SR--WSRC-CSWE-1998-0013)

The pipe fitter was using the drill motor on a metal scaffold. He had installed a wire brush in the drill motor and had laid it on the scaffold for use after welds were completed. Investigators believe that the welding machine became grounded to the scaffold by inadvertent contact with a pipe that was being welded. They discovered the following conditions during their post-use inspection of the welder.

- The outlet connections for welding leads were loose or broken.
- Voltage at the duplex receptacle used to power the drill motor was approximately 200 V ac, and voltage to a single receptacle was approximately 154 V ac.
- The idle control was not working properly. The machine operated at a speed of 3,000 to 4,000 rpm, which is significantly higher than normal.
- Insulation on the internal ground wiring for the duplex receptacle had been damaged, and the wire was embrittled by excessive heat. This damage could not have been caused by the abnormally high voltage at the duplex receptacle because an internal cutout prevents delivering welding current and power to the auxiliary receptacles simultaneously.
- Labels on switches and outlets were missing or unreadable. Operation of welding machines is normally entrusted to "skill-of-the-craft."
- The auxiliary receptacles were wired correctly for 120 V ac.

Investigators identified two principal causes of this occurrence: poor connection of the welding ground lead at the pipe or at the welding machine receptacle and contact between the scaffold

and the pipe. They believe that a portion of welding current returned to welding machine ground through a loop formed by the pipe, the scaffold, the drill motor, the extension cord ground wire, and the ground connection for the duplex receptacle. Investigators also believe that this abnormal loading scheme damaged internal circuits to cause the excessive idle speed and the abnormally high voltage at the receptacles they observed after the occurrence.

Facility personnel have completed the following corrective actions.

- Properly label all controls and outlets on portable welding machines.
- Equip all portable generating equipment, including portable welders, with overcurrent protection and ground-fault current interrupt receptacles, and ensure that neutral is bonded to the equipment frame or housing.
- Require visual inspections of the outlet connections of all portable welders and ac generating equipment before issuing them (by owners) and before using them (by users).
- Develop a lessons learned for users of portable welding equipment to ensure that ground leads are properly landed at welding sites and that conditions at work sites do not establish alternative ground paths for weld current.

KEYWORDS: power supply, voltage, welding

FUNCTIONAL AREAS: Construction, Industrial Safety

OEAF FOLLOW-UP ACTIVITY

1. CORRECTION TO WEEKLY SUMMARY 99-01, ARTICLE 5

The article incorrectly identified the East Tennessee Technology Park (ETTP) as being part of the Oak Ridge National Laboratory (ORNL). Although the ETTP, formerly K-25, is located in Oak Ridge, it is no longer associated with ORNL and is operated and managed by British Nuclear Fuel. Other articles that made this incorrect reference are in Weekly Summaries 98-15, 98-31, 98-32, 98-39, 98-47, and 98-50.

KEYWORDS: decommissioning, hazard analysis, pre-job briefing, pre-job planning, safety

FUNCTIONAL AREAS: Decontamination and Decommissioning, Integrated Safety Management